A screening to study the effect of smoke solutions, gibberellic acid, and cold-moist stratification on various grass species©

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INTRODUCTION

The research was conducted to serve as screening of several grass species to determine the effect smoke, gibberellic acid, and cold-moist stratification had on germination.

Researchers have discovered that there are two important compounds inside smoke: karrikins and cyanohydrins. Scientists have isolated four different karrikins compounds ranging from Kar_1 to Kar_4. When karrikins are released from smoke, the compound rests in the soil. Once precipitation occurs, the compound mixes with the soil and germination occurs. Plants that are known to positively correlate with smoke are called "fire-followers." These types of plants typically have an evolutionary history of living in environments where fires are present.

MATERIALS AND METHODS

The experimental groups were a 0.5, 1.0, and 2.0% gibberellic acid solutions and the same solutions mixed with "Cape Seed Primer" smoke paper [one disk per 50 mL deionized water (DI)]. There was also one experimental group consisting of just smoke paper and a DI water solution as the control.

Utilize a 10.0, 5.0, and 1.0% bleach solution for sterilization of each species. Place seeds in each solution for 1 min. Between each sterilization, rinse the seeds in DI water for 1 min. Change out the water between each rinse. Seeds were soaked in each experimental solution or control for 24 h. Once the 24 h was complete, seeds were removed from the solutions and placed into Petri plates with filter paper and 2.5 mL DI water. Forty seeds per plate were transferred for a total of 8 Petri plates per experimental group. Seeds were stored in a 1.6-4.4°C cold room for 30 or 60 days depending on the experimental trial. Once cold-moist stratification was complete, all seeds were transferred to new Petri plates with a filter paper and 2.5 mL of DI water.

There were a total of 16 Petri plates, each containing 20 seeds transferred to the growth chamber. The growth chamber was set to 23°C for 12-h light period and 15°C for a 12-h dark period each 24 h.

RESULTS

The percent germination was collected once a week for a total of 3 weeks. Results are presented in Table 1.

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Table 1. Germination rate (%) for selected grass species with a 30 and 60 day cold-moist stratification period, a cold-moist stratification with gibberellic acid, and cold-moist stratification with gibberellic acid plus smoke. The table above displays the percent germination for each grass species 30- and 60-day cold-moist stratification. The values of 30 and 60 after each species represents the number of cold-moist stratification days for the individual trial.

Species	Control	0.5% GA	1% GA	2% GA	Smoke paper	.5% GA and smoke paper	1% GA and smoke paper	2% GA and smoke paper
Sporobolus compositus (syn. *S. asper*) (30)	8.15	13.13	6.25	14.38	18.75	10.63	12.50	9.38
Sporobolus. compositus (60)	0.00	5	11.25	18.75	22.50	35.00	34.38	35.00
Sporobolus cryptandrus (30)	0.63	7.50	10.63	15.63	2.50	8.13	20.00	14.38
Sporobolus cryptandrus (60)	6.25	15.63	15	22.50	5.63	16.88	27.50	26.25
Sporobolus heterolepis (30)	63.75	68.75	58.13	65.63	68.13	69.38	68.13	64.38
Sporobolus heterolepis (60)	73.75	72.50	73.13	70.63	69.38	70.00	76.25	73.75
Agrostis hyemalis (30)	NA	6.25	25.63	26.88	30.63	26.25	14.38	25
Agrostis hyemalis (60)	36.00	36.88	38.75	36.88	28.13	41.25	28.75	25.00
Chasmanthium latifolium (30)	20.63	23.13	26.25	19.38	16.88	27.50	25.63	20.00
Chasmanthium latifolium (60)	39.38	56.25	50.63	43.75	40.00	31.25	33.75	48.75
Scirpus atrovirens (30)	15.00	9.38	8.13	4.38	14.38	7.50	11.25	11.25
Scirpus atrovirens (60)	12.50	6.25	8.13	4.38	13.25	7.50	8.13	10.63

Additional reading

Fornwalt, P. (2015). Does smoke promote seed germination in 10 interior west penstemon species? Native Plants *16* (*1*), 5–12. http://npj.uwpress.org/content/16/1/5.abstract.

Guo, Y., Zheng, Z., La Clair, J.J., Chory, J., and Noel, J.P. (2013). Smoke-derived karrikin perception by the α/β-hydrolase KAI2 from *Arabidopsis.* Proc. Natl. Acad. Sci. U.S.A. *110* (*20*), 8284–8289 https://doi.org/10.1073/pnas.1306265110. PubMed

Krock, S., Smith, S., Elliott, C., Kennedy, A., and Hamman, S.T. (2016). Using smoke-water and cold-moist stratification to improve germination of native prairie species. Native Plants J. *17* (*1*), 19–27 https://doi.org/10.3368/npj.17.1.19.